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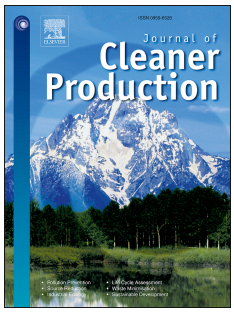

Sustainable mechanisms of biochar derived from brewers' spent grain and sewage sludge for ammonia-nitrogen capture

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Sustainable mechanisms of biochar derived from brewers' spent grain and sewage sludge for ammonia-nitrogen capture

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ABSTRACT

The limitations of the existing means of treating brewers' spent grain and sewage sludge highlight the need to find sustainable routes to manage them. Biochars derived from their mixtures enriching with magnesium and phosphorus, through pyrolysis at 400-700°C, were characterized, and their potential use as a capture agent for ammonia-nitrogen removal in aqueous solutions was also analyzed. The yield increased with rising brewers' spent grain ratio, but decreased with increasing temperature. Higher pyrolysis temperature caused higher ash content, pH, surface basicity, specific surface area, and mineral element concentrations, whereas lower surface acidity, cation exchange capacity and nitrogen contents. Biochars derived from the mixtures of brewers' spent grain and sewage sludge (80:20, wt%) gained the highest removal efficiencies of ammonia-nitrogen, owing to their high surface area, magnesium and phosphorus availability, suitable surface chemistry and

Abbreviations: BSG, brewers' spent grain; SS, sewage sludge; NH_4^+-N, ammonia–nitrogen; MAP, magnesium ammonium phosphate; SSA, specific surface area; CEC, cation exchange capacity; BSC400, BSC500, BSC600 and BSC700, derived from BSG and SS mixture (80:20, wt%) at 400, 500, 600, and 700°C, respectively; TC500, TC600 and TC700, derived from *T. dealbata* at 500, 600, and 700°C, respectively. CSAC derived from coconut shell at 800°C (precarbonization and activation); BM300, derived from hardwood shavings at 300°C.

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